The Pathway to Hydrogen: Passing through Clean Cities?

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Our Panelists

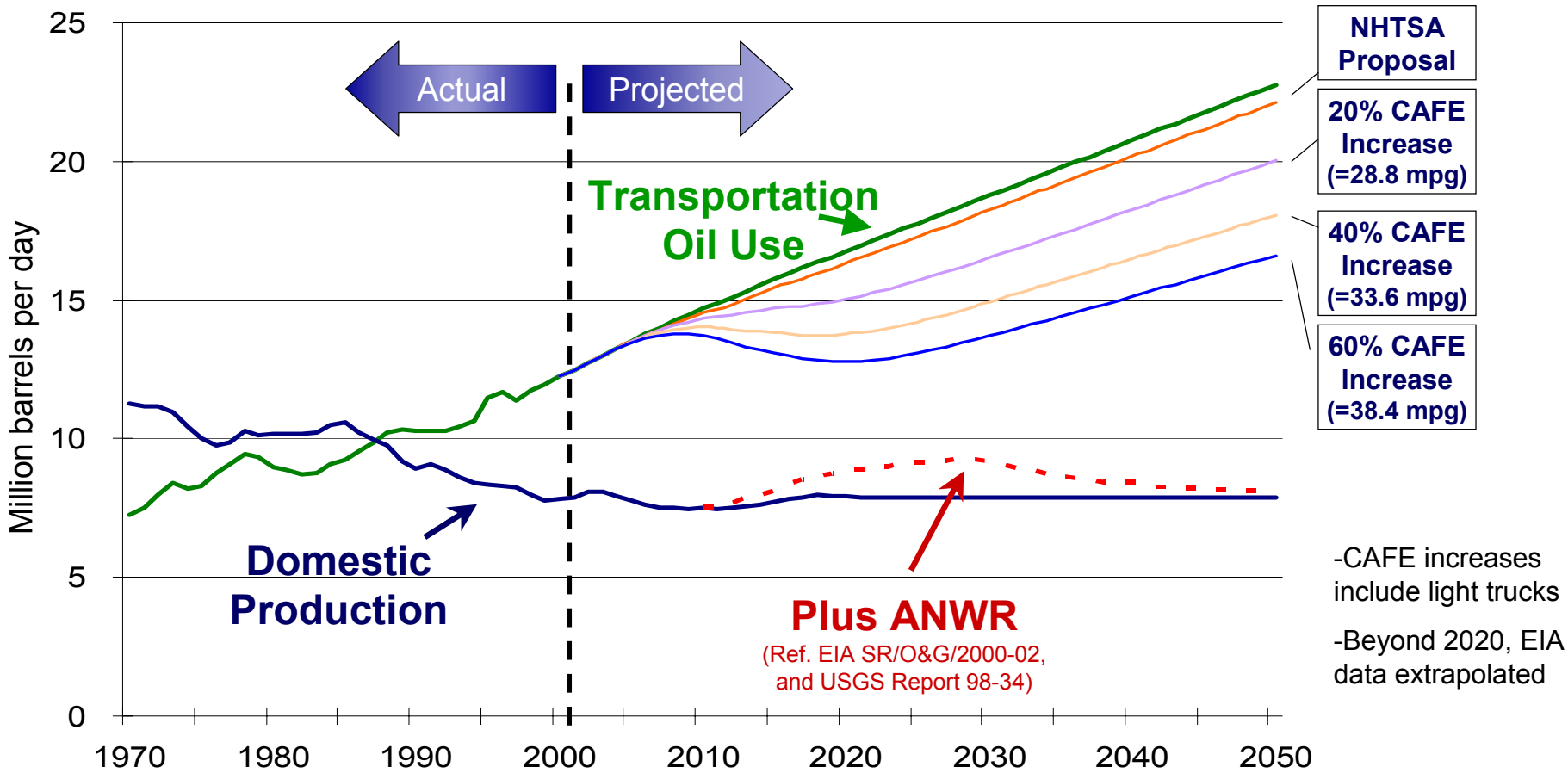
- Steve Ellis, American Honda
- Venki Raman, Air Products
- Bill Reinart, Toyota
- Cynthia Verdugo-Peralta, SCAQMD

It's Not CAFE vs. ANWR

- Even an *immediate* 60% increase in Corporate Average Fuel Economy (CAFE) standards *and* new production from the Arctic National Wildlife Refuge (ANWR) will not close the gap between demand and domestic production.

A TOTALLY NEW APPROACH IS NEEDED!

The Oil "Gap" Is Growing



-CAFE increases include light trucks

-Beyond 2020, EIA data extrapolated

FreedomCAR Launched

January 9, 2002

Secretary Abraham announces the FreedomCAR Partnership

FreedomCAR (Cooperative Automotive Research) is a partnership between DOE and the U.S. Council for Automotive Research, a cooperative endeavor among DaimlerChrysler, Ford, and GM to conduct pre-competitive research

Our long term vision: A transportation system powered by hydrogen derived from a variety of domestic resources.

President Bush Launches the Hydrogen Fuel Initiative

"Tonight I am proposing $1.2 billion in research funding so that America can lead the world in developing clean, hydrogen-powered automobiles.

"With a new national commitment, our scientists and engineers will overcome obstacles to taking these cars from laboratory to showroom *so that the first car driven by a child born today could be powered by hydrogen, and pollution-free.*

"Join me in this important innovation to make our air significantly cleaner, and our country much less dependent on foreign sources of energy."

President George W. Bush
2003 State of the Union Address
January 28, 2003

Hydrogen Infrastructure and Fuel Cell Technologies Accelerated

- **President Bush commits $1.7 billion over first 5 years:**
  - $1.2 billion for hydrogen and fuel cells RD&D ($720 million in new money)
  - $0.5 billion for hybrid and vehicle technologies RD&D
- **Accelerated, parallel track to enable industry commercialization decision by 2015.**

Fuel Cell Vehicles in the Showroom and Hydrogen at Fueling Stations by 2020

Program Strategy for Transitioning to a Hydrogen Economy

- **Conduct R&D to solve critical path technologies**
  - Hydrogen Storage (7.5 wt%; 1100 W-h/l, $5/kW-h)[Under discussion with FreedomCAR partners]
  - Hydrogen Production Cost (NG-based $1.50/gge untaxed)
  - Fuel Cell Cost (2010:$45/kW; 2015:$30/kW)

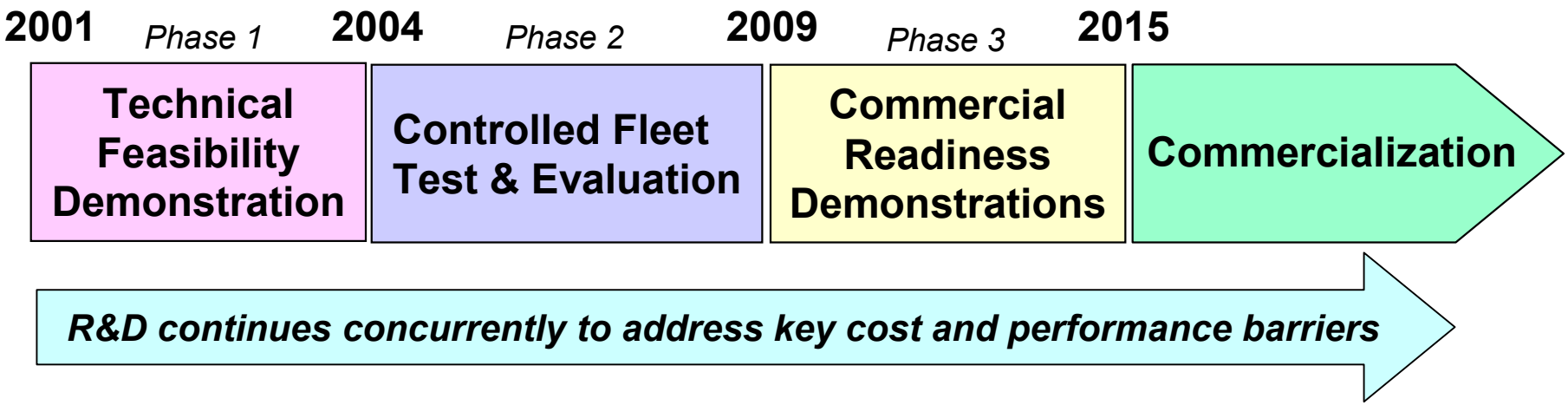
- **Validate technology development through "learning" demonstrations**
  - Centrally fueled vehicles and production/refueling infrastructure
  - Power park concept

- **Codes and standards development**

Field Demonstration Program

Goal: To determine if investment is warranted in fuel cell vehicles and H_2 infrastructure technologies at commercial production volumes

Potential Demonstration Program



Subsequent phases only proceed if success criteria for the previous phase have been met.

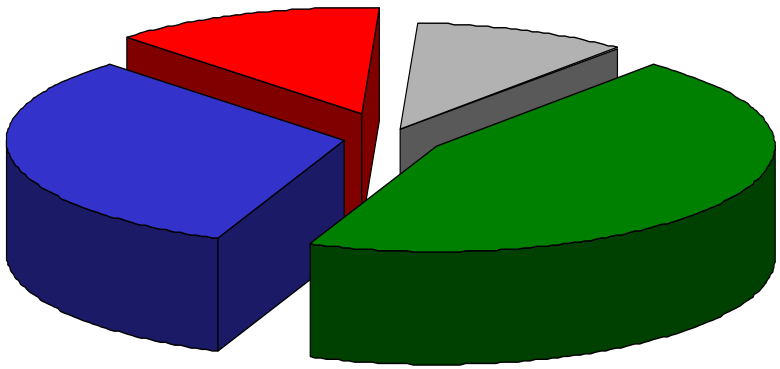
Fiscal Year 2004 Hydrogen Production Funding ($38.5M)

DOE Offices of Fossil Energy, Nuclear Energy, and Energy Efficiency and Renewable Energy are collaborating on cost-shared hydrogen production R&D:

Coal - $5 million (FE)
- Separation of pure hydrogen gas from synthesis gas (CO and hydrogen)
- Technologies also applicable to biomass feedstocks

Nuclear - $4 million (NE)
- High temperature chemical cycles for splitting water

Natural Gas – $12.2 million (FE/EERE)
- Small, distributed systems to begin making hydrogen available at local refueling stations
- Centralized Production



Renewables - $17.3 million (EERE)
- Direct water splitting using solar energy
- Thermal processes using biomass
- Advanced electrolysis from wind power
- Biological WGS Processes

Energy Independence Through Diversity of Domestic Supplies

The Road to a Hydrogen Economy

Known Sources For Hydrogen:

- Biomass
- Natural Gas
- Electricity
- Coal